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**ANORTHOSITES AND ALKALINE ROCKS FROM THE DEEP  
CRUST OF PENINSULAR INDIA** C. Leelanandam, J. Ratnakar, and  
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Anorthosites and alkaline rocks are potentially useful as geochemical probes of their mantle sources at very early to early periods of the evolutionary history of the Earth's crust. There are about forty anorthosite and an equal number of alkaline rock occurrences in the Precambrian shield of Peninsular India (Figs. 1 & 2), and a great majority of them are virtually restricted to the Eastern Ghat mobile (granulite) belt which is comparable to the Grenville province of Canada.

The Archaean and Proterozoic anorthosite complexes cover a total area of over 1300 km<sup>2</sup>. Among the Archaean anorthosite complexes, the Chimalpahad (1) complex (~200 km<sup>2</sup>) is similar in certain respects to the Sittampundi (2) complex (7-12 kb; 675-850°C). Some of the Proterozoic anorthosite massifs which are geographically very far away exhibit remarkable similarities; the Bankura (3,4) and Bolangir (5) massifs were equilibrated at metamorphic temperatures (~650°C) and pressures (~6kb) corresponding to depths of 15-25 km, while that of Oddanchatram (6) was equilibrated at a higher temperature (980 ± 20°C) and lower pressure (~5.3 kb).

The alkaline plutons covering a total area of ~450 km<sup>2</sup> have diverse lithologies and variable rock associations. Rocks with 50-65% SiO<sub>2</sub> (nepheline syenites and syenites) are abundant, while those with 65-70% SiO<sub>2</sub> (quartz syenites and alkali granites) are less abundant; carbonatites and ocellar lamprophyres (camptonites and sannaites) are conspicuous, though insignificant, members of some alkaline plutons. Most of the nepheline syenites are miaskitic (7) and are of igneous origin (700-880°C). The undersaturated and oversaturated syenites are supposed to have formed from a critically undersaturated hornblende syenitic magma by a branching differentiation mechanism from an originally hydrous alkaline basalt magma as at Purimetla (8) in the Prakasam province (9), east of the Cuddapah basin (Fig.1).

The charnockitic (gneiss-granulite) region of Peninsular India is uplifted as a whole relative to the non-charnockitic (granite-greenstone) region and Fernor's line (10) forms an abrupt discontinuity between contrasting geologic terrains. The metamorphic discontinuity across the boundary between the Eastern Ghats and the adjoining craton, as at the eastern margin of the Cuddapah basin (11-13), suggests thrusting of the eastern terrain (deeper crustal levels) over the western terrain (shallower levels). The boundary (comparable to the Grenville Front) is marked by the presence of an east dipping thrust zone (see the inset map of Fig.1) separating the younger crustal blocks of the Eastern Ghat province from the older blocks of the craton (14). Models invoking collision tectonics with attendant anomalous crustal thickening of the Proterozoic mobile belt and with high thermal gradients may explain the anorthosite genesis. The granulite terrains subsequently developed very low thermal gradients and experienced the alkaline magmatism signifying very deep melting in middle-late Proterozoic times (15). The faults and deep fractures in the thickened and shortened continental crust passively allowed the emplacement of post-orogenic alkaline plutons. There is no perceptible clustering

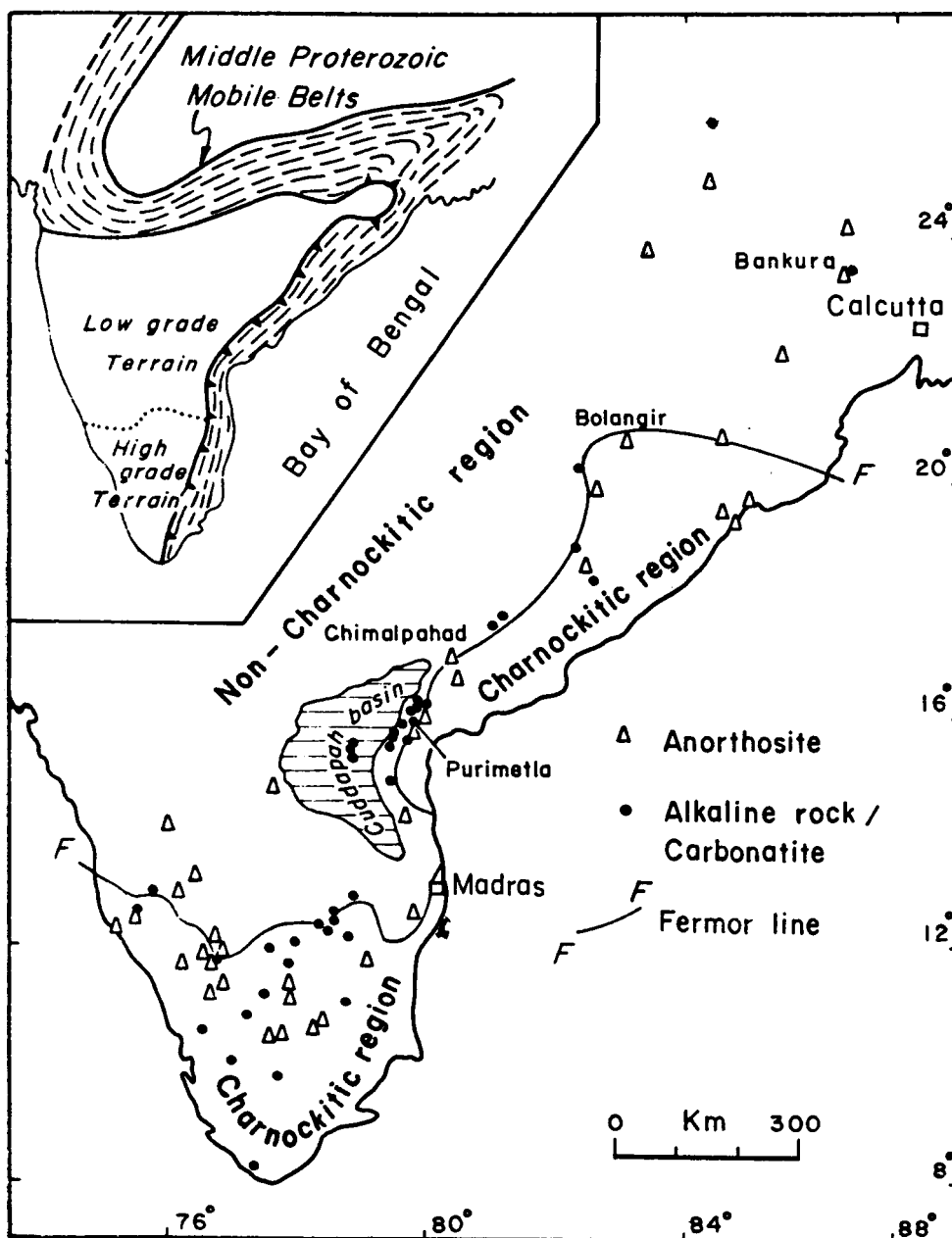


Fig.1

of either anorthosite or alkaline plutons in the Proterozoic shear zones in south India (Fig.2), though the plutons are almost confined to the Proterozoic mobile belt representing deep crust of Peninsular India.

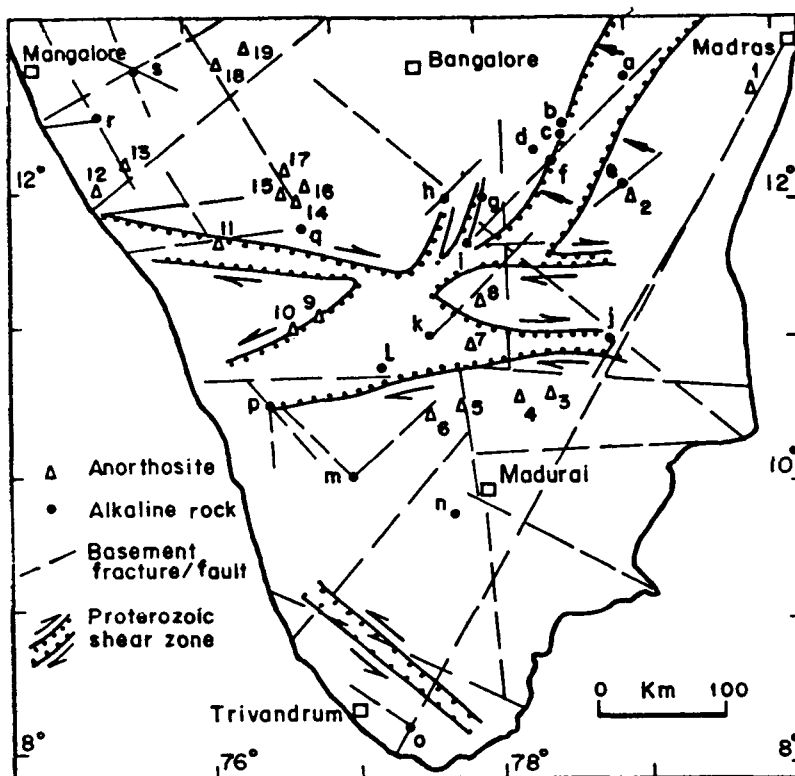


Fig. 2

**Anorthosites:** 1.Chinglepet, 2.Mamandur, 3.Manapparai, 4.Kadavur, 5.Oddan-chatram, 6.Palni, 7.Chinnadharapuram, 8.Sittampundi, 9.Togamalai, 10.Atta-padi, 11.Kabbani, 12.Perinthatta, 13.Kottanjariparambu, 14.Gundlupet, 15.Hulla-halli, 16.Konkanhundi, 17.Sindhuvali, 18.Holenarasipur, 19.Nuggihalli.

**Alkaline rocks:** a.Paravamalai, b.Elagiri, c.Koratti, d.Sampalpatti, e.Tora-paddi, f.Sevattur, g.Piccili, h.Hogenkal, i.Pakkanadu, j.Ariyalur, k.Sivam-alai, l.Kundurubetta, m.Munnar, n.Kammam mettu, o.Puttetti, p.Mannapra, q.Sholayar, r.Sullia, s.Peralimala.

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